

REMARKS

The Office Action mailed June 22, 2006, has been received and reviewed. Claims 1 through 43 are currently pending in the application. Claims 1 through 43 stand rejected. Applicant respectfully requests reconsideration of the application in view of the arguments set forth below.

Preliminary Amendment

Applicant's undersigned attorney notes the filing herein of a Preliminary Amendment on April 13, 2004, which filing was not acknowledged in the outstanding Office Action. Should the Preliminary Amendment have failed for some reason to have been entered in the Office file, Applicant's undersigned attorney will be happy to have a true copy thereof hand-delivered to the Examiner.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 3,490,638 to Elliott et al. in view of U.S. Patent No. 4,614,279 to Toth et al.

Claims 1 through 9, and 12 through 31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Elliot et al. (U.S. Patent No. 3,490,638) in view of Toth et al. (U.S. Patent No. 4,614,279). Applicant respectfully traverses this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

The 35 U.S.C. § 103(a) obviousness rejections of claims 1 through 9, and 12 through 31 are improper because 1 through 9, and 12 through 31 because there is a lack of motivation to

combine the references relied upon by the Examiner and because there is not a reasonable expectation of success.

Claims 1 through 9 and 12 through 15

Independent claim 1 of the presently claimed invention is directed to a vessel. The vessel comprises: a vessel body having at least one surface which is curved about both a vessel body axis and a second axis; and a reinforcing structure comprising a plurality of gore pieces, each gore piece comprising a sheet of composite material including *a first surface, a second opposing surface and a plurality of fibers extending substantially parallel to the first surface*, each gore piece exhibiting a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece, wherein the first longitudinal location of each gore piece is disposed at a first radial distance from the vessel body axis, the second longitudinal location of each gore piece is disposed at a second lesser distance from the vessel body axis, and wherein at least a portion of the first surface of each gore piece is disposed over and conforms to at least a portion of the at least one surface of the vessel body.

The Examiner cites Elliot as disclosing a vessel including a reinforcing structure comprising a plurality of gore pieces (strip 26) wherein each gore piece includes a sheet of fiber reinforced resin matrix material having a first (inside) surface and a second opposing (outside). Additionally, the Examiner cites Elliot as teaching that each gore piece “has the geometric relationship claimed with first width, second lesser width, first longitudinal location at a greater radial distance and a second longitudinal location at a lesser radial distance.” (Office Action, page 2).

The Examiner then cites Toth as teaching a “vessel with a vessel body (liner 12) with a reinforcing structure (reinforcement 14) disposed over and in conforming to the entire surface of the vessel body.” (*Id.*). The Examiner also cites Toth as teaching “fibers oriented parallel to the inner (first) surface of the reinforcement 14.” (*Id.*). The Examiner states that it “would have been obvious to add an inner liner layer to provide a layer more compatible with the contents of the

vessel” and that it “would have been obvious to reorient the fibers of Elliot from radial to a direction parallel to the inside surface of the reinforcement to better reduce tensile and hoop stress within the reinforcement.” (*Id.*) Applicant respectfully disagrees.

Elliot discloses a hollow, shell-type, deep submergence vessel. The vessel is formed of a plurality of radial-filament sphere segments with the segments being constructed from initially flat panels of unidirectional filament-reinforced resin wherein all filaments are oriented *normal* to the panels’ respective inner and outer surfaces. (See, e.g., col. 1, lines 13-16; col. 4, line 57-73; and FIGS. 2-6, 6a and 10). It is noted that the normal orientation of the filaments is deemed an important, if not critical, feature of Elliot’s vessel. More particularly, Elliot teaches the following:

In a hollow spherical vessel subjected to external hydrostatic pressure over its entire surface, the external pressure is opposed by balanced circumferential stresses in the wall of the vessel, and any given element of such a body can thus be considered as being subjected to two perpendicular compressive stresses, both essentially parallel to the surface. The general equation for the circumferential stress in a spherical shell under external hydrostatic pressure is

$$(1) \quad \sigma = \frac{Pr}{2t}$$

where P is the unit pressure, r is the mean radius of the sphere, and t is the wall thickness of the shell. If, now, each such element of the shell body is composed of a unidirectional-filament slab in which *all the individual fibers are oriented substantially radially of the sphere* and thus *normal to the plane of application of the compressive stresses*, the fibers in each element of the shell body will be stressed in tension. Thus, *no buckling of the filaments can occur*, which obviates the requirement of a high degree of straightness in the fibers and effective lateral support by the resin. *It will be readily recognized that this is precisely opposite to the situation existing in conventional filament-wound spheres, where transverse*

buckling of the filament windings is resisted only by the lateral support provided by the resin. (Col. 3, lines 31-56, emphasis added).

Thus, Elliot teaches away from the present invention in requiring that the filaments be oriented *normal* to the their respective panel's inner and outer surfaces. Any modification of Elliot's panels to include filaments oriented substantially *parallel* to their respective panel's inner and outer surfaces would result in a vessel unable to withstand any substantial external hydrostatic pressure that is applied over the entire surface of the vessel. In other words, such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose, if not inoperable. Thus, one of ordinary skill in the art, at the time the invention was made, would not have modified the Elliot vessel by orienting the filaments in a manner similar to that taught by Toth.

Furthermore, there is not a reasonable likelihood of success that such a modification would work since, as set forth by Elliot, transverse buckling of conventional filament-wound spheres is "resisted only by the lateral support provided by the resin." (Col. 3, lines 55-56).

Applicant, therefore, submits that the combination of Elliot and Toth do not render claim 1 obvious. Applicant further submits that claims 2 through 9 and 12 through 15 are allowable as being dependent upon an allowable base claim, as well as for the additional patentable subject matter introduced thereby.

With respect to claim 5 through 7, Applicant submits that one of ordinary skill in the art would not be motivated to orient the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of the respective for piece. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would each exhibit a similar orientation relative to a longitudinal axis of the panel. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

With respect to claim 9, Applicant submits that one of ordinary skill in the art would not be motivated to orient at least some of the plurality of fibers to effectively intersect one another and define a space configured substantially as a rhombic section. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would not intersect each other to define such a configuration. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

With respect to claims 14 and 15, Applicant submits that Elliot and Toth fail to teach or suggest gore pieces, configured as set forth in claim 1 of the presently claimed invention, wherein a longitudinal axis along the length of each gore piece is offset with respect to the vessel body axis. Rather, all of the panels of Elliot appear to be oriented with longitudinal axes which are parallel with the vessel body axis. Furthermore, Applicant submits that Toth does not teach or suggest such subject matter.

Applicant, therefore, respectfully requests reconsideration and allowance of claims 1 through 9 and 12 through 15.

Claims 16 through 24

Independent claim 25 is directed to a reinforcing structure for a vessel having a vessel body with at least one surface which is curved about both a vessel body axis and a second axis. The reinforcing structure comprises: a plurality of gore pieces, each gore piece of the plurality comprising a sheet of composite material including a first surface, a second opposing surface *and a plurality of fibers extending substantially parallel to the first surface*, each gore piece exhibiting a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece, wherein the first longitudinal location of each gore piece is configured to be disposed at a first radial distance from the vessel body axis and wherein the second longitudinal location of each gore piece is configured to be disposed at a second lesser radial distance from the vessel body axis, and wherein at least a portion of the first surface of each gore piece is disposed over and

conforms to at least a portion of the at least one surface of the vessel body.

The Examiner relies on Elliot and Toth as applied to claim 1 and as set forth hereinabove.

As discussed above, Elliot actually teaches away from the present invention in requiring that the filaments be oriented *normal* to the their respective panel's inner and outer surfaces. Any modification of Elliot's panels to include filaments oriented substantially *parallel* to their respective panel's inner and outer surfaces would result in a vessel unable to withstand any substantial external hydrostatic pressure which was applied over the entire surface of the vessel. In other words, such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose, if not wholly inoperable. Thus, one of ordinary skill in the art, at the time the invention was made, would not have modified the Elliot vessel by orienting the filaments in a manner similar to that taught by Toth.

Furthermore, there is not a reasonable likelihood of success in implementing the Examiner's proposed modifications to the structure of Elliot since, as expressly stated by Elliot, transverse buckling of conventional filament-wound spheres would be "resisted only by the lateral support provided by the resin." (Col. 3, lines 55-56).

Applicant, therefore, submits that the combination of Elliot and Toth do not render claim 16 obvious. Applicant further submits that claims 17 through 24 are allowable as being dependent upon an allowable base claim, as well as for the additional patentable subject matter introduced thereby.

With respect to claims 20 through 22 Applicant submits that one of ordinary skill in the art would not be motivated to orient the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of the respective for piece. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would each exhibit a similar orientation relative to a longitudinal axis of the panel. Such a modification would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

With respect to claim 23, Applicant submits that one of ordinary skill in the art would not be motivated to orient at least some of the plurality of fibers to effectively intersect one another and define a space configured substantially as a rhombic section. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would not intersect each other to define such a configuration. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Applicant, therefore, respectfully requests reconsideration and allowance of claims 16 through 24.

Claims 25 through 31

Independent claim 25 of the presently claimed invention is directed to a method for making a reinforcing structure for a vessel having a vessel body with at least one surface which curves about both a vessel body axis and a second axis. The method comprises: forming a plurality of gore pieces for disposition on the at least one surface of the vessel body including forming each of the plurality of gore pieces as a sheet of composite material having a first surface, a second opposing surface *and a plurality of fibers extending substantially parallel to the first surface*; defining each gore piece to exhibit a length, a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece; disposing at least a portion of the first surface of each gore piece on at least a portion of the at least one surface of the vessel body such that the first longitudinal location of each gore piece is disposed at a first distance from the vessel body axis and the second longitudinal location of each gore piece is disposed at a second lesser distance from the vessel body axis; and conforming the at least a portion of the first surface of each gore piece to the at least a portion of the at least one surface of the vessel body.

The Examiner relies on Elliot and Toth as applied to claim 1 and as discussed hereinabove.

As discussed above, Elliot actually teaches away from the present invention in requiring that the filaments be oriented *normal* to the their respective panel's inner and outer surfaces. Any modification of Elliot's panels to include filaments oriented substantially *parallel* to their respective panel's inner and outer surfaces would result in a vessel unable to withstand any substantial external hydrostatic pressure which was applied over the entire surface of the vessel. In other words, such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose if not wholly inoperable. Thus, one of ordinary skill in the art, at the time the invention was made, would not have modified the Elliot vessel by orienting the filaments in a manner similar to that taught by Toth.

Furthermore, there is not a reasonable likelihood of success that such a modification would work since, as set forth by Elliot, transverse buckling of conventional filament-wound spheres is "resisted only by the lateral support provided by the resin." (Col. 3, lines 55-56).

Applicant, therefore, submits that the combination of Elliot and Toth do not render claim 25 obvious. Applicant further submits that claims 26 through 31 are allowable as being dependent upon an allowable base claim, as well as for the additional patentable subject matter introduced thereby.

With respect to claims 26 and 27, Applicant submits that one of ordinary skill in the art would not be motivated to orient the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of the respective for piece. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would each exhibit a similar orientation relative to a longitudinal axis of the panel. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

With respect to claim 29, Applicant submits that one of ordinary skill in the art would not be motivated to orient at least some of the plurality of fibers to effectively intersect one another and define a space configured substantially as a rhombic section. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot's panels are parallel

to each other (see, e.g., col. 4, lines 64-65) and thus would not intersect each other to define such a configuration. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Applicant, therefore, respectfully requests reconsideration and allowance of claims 25 through 31.

Obviousness Rejection Based on U.S. Patent No. 3,490,638 to Elliott et al. in view of U.S. Patent No. 4,614,279 to Toth et al. and U.S. Patent No. 5,653,358 to Sneddon

Claims 10, 11, and 32 through 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Elliott et al. (U.S. Patent No. 3,490,638) in view of Toth et al. (U.S. Patent No. 4,614,279) and Sneddon (U.S. Patent No. 5,653,358). Applicant respectfully traverses this rejection, as hereinafter set forth.

Claims 10 and 11

Claims 10 and 11 each depend from independent claim 1. Claim 10 recites the additional subject matter of the vessel body comprising a first layer of gore pieces disposed around the at least one surface, and sequential ones of the first layer of gore pieces overlap one another. Claim 11 further recites that each of the first layer of gore pieces overlaps an adjacent first layer gore pieces by about 40 to 60 percent.

The Examiner relies on Elliot and Toth as applied to claim 1, and then cites Sneddon as teaching a reinforcement structure (outer jacket 16) constructed by superimposing and overlapping layers of impregnated filamentary material such as shown in FIGS. 2 and 3. The Examiner then states that it would have been obvious “to overlap the gore pieces over one another rather than to abut the gore pieces to insure that an inconsistency at the edge of a gore piece doesn’t result in an opening in the reinforcement structure which can leave a portion of the vessel body unprotected and unreinforced and could also result in stress concentrations leading to reinforcement structure stress cracks and ultimately catastrophic pressure vessel failure.” (Office Action, page 4). Applicant respectfully traverses this rejection as set forth hereinbelow.

As previously discussed herein, Elliott and Toth fail to render claim 1 obvious. More specifically, Elliot teaches away from the present invention in requiring that the filaments be oriented *normal* to the their respective panel's inner and outer surfaces. Any modification of Elliot's panels to include filaments oriented substantially *parallel* to their respective panel's inner and outer surfaces would result in a vessel unable to withstand any substantial external hydrostatic pressure that is applied over the entire surface of the vessel. In other words, such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose, if not inoperable. Thus, one of ordinary skill in the art, at the time the invention was made, would not have modified the Elliot vessel by orienting the filaments in a manner similar to that taught by Toth.

Furthermore, there is not a reasonable likelihood of success that such a modification would work since, as set forth by Elliot, transverse buckling of conventional filament-wound spheres is "resisted only by the lateral support provided by the resin." (Col. 3, lines 55-56).

Sneddon fails to remedy the shortcomings of Elliott and Toth in this regard.

Applicant, therefore, respectfully requests reconsideration and allowance of claims 10 and 11.

Claims 32 through 43

Independent claim 32 of the presently claimed invention is directed to a method for reinforcing a vessel having a vessel body with at least one surface which is curved about both a vessel body axis and a second axis. The method comprises: providing a plurality of gore pieces, each gore piece comprising a sheet of composite material having a first surface, a second opposing surface and *a plurality of fibers extending substantially parallel to the first surface*, each gore piece exhibiting a first width at a first longitudinal location along a length of each gore piece and a second lesser width at a second longitudinal location along the length of each gore piece; forming a gore body including disposing the plurality of gore pieces on the vessel body at the at least one surface of the vessel body such that the first longitudinal location of each gore piece is disposed at a first distance from the vessel body axis and the second longitudinal location

of each gore piece is disposed at a lesser second distance from the vessel body axis and such that at least a portion of the first surface of each gore piece is configured to be disposed upon and conform to at least a portion of the at least one surface of the vessel body; and overlapping a portion of at least one of the plurality of gore pieces with a portion of at least one other of the plurality of gore pieces.

The Examiner relies on the combination of Elliot and Toth as applied to claims 1, 16 and 25 and as discussed hereinabove. The Examiner further relies on Sneddon as teaching a reinforcement structure (outer jacket 16) constructed by superimposing and overlapping layers of impregnated filamentary material such as shown in FIGS. 2 and 3. The Examiner then states that it would have been obvious “to overlap the gore pieces over one another rather than to abut the gore pieces to insure that an inconsistency at the edge of a gore piece doesn’t result in an opening in the reinforcement structure which can leave a portion of the vessel body unprotected and unreinforced and could also result in stress concentrations leading to reinforcement structure stress cracks and ultimately catastrophic pressure vessel failure.” (*Id.*) Applicant respectfully traverses this rejection as set forth hereinbelow.

As discussed above, Elliot actually teaches away from the present invention in requiring that the filaments be oriented *normal* to the their respective panel’s inner and outer surfaces. Any modification of Elliot’s panels to include filaments oriented substantially *parallel* to their respective panel’s inner and outer surfaces would result in a vessel unable to withstand any substantial external hydrostatic pressure which was applied over the entire surface of the vessel. In other words, such a configuration would likely result in the buckling of the vessel under any substantial external pressure, thereby rendering the Elliot vessel inadequate for its intended purpose. Thus, one of ordinary skill in the art, at the time the invention was made, would not have modified the Elliot vessel by orienting the filaments in a manner similar to that taught by Toth.

Furthermore, one of ordinary skill in the art would not be motivated to overlap the panels of Elliot, as taught by Sneddon, as such would result in a vessel which relied upon the bonding strength of the resin to keep adjacent panels from tearing apart when subjected to external hydrostatic pressures. In other words, the abutting nature of the panels in Elliot clearly provides

a resistance against buckling or collapsing when the vessel is subjected to such external pressures and, as such, one ordinary skill in the art would avoid such a modification of the Elliot vessel.

Moreover, there is not a reasonable likelihood of success that such a modification would work since, as set forth by Elliot, transverse buckling of conventional filament-wound spheres is “resisted only by the lateral support provided by the resin.” (Col. 3, lines 55-56). Such would likely occur as a result of overlapping the panels of Elliot in the manner taught by Sneddon.

Applicant, therefore, submits that the combination of Elliot, Toth and Sneddon do not render claim 32 obvious. Applicant further submits that claims 42 through 48 and 56 are allowable as being dependent upon an allowable base claim, as well as for the additional patentable subject matter introduced thereby.

With respect to claims 35 through 37, Applicant submits that one of ordinary skill in the art would not be motivated to orient the plurality of fibers in a plus/minus configuration relative to a longitudinal axis along the length of the respective for piece. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot’s panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would each exhibit a similar orientation relative to a longitudinal axis of the panel. Such a modification would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

With respect to claim 39, Applicant submits that one of ordinary skill in the art would not be motivated to orient at least some of the plurality of fibers to effectively intersect one another and define a space configured substantially as a rhombic section. As noted by Elliot, in order to withstand substantial external hydrostatic pressures, the filaments of Elliot’s panels are parallel to each other (see, e.g., col. 4, lines 64-65) and thus would not intersect each other to define such a configuration. Modification of such would render the Elliot vessel inadequate for its intended purpose since the orientation of the filaments is deemed to be important, if not critical, to the proper operation of the vessel.

Applicant, therefore, respectfully requests reconsideration and allowance of claims 32 through 43.

Double Patenting Rejection Based on U.S. Patent No. 6,719,165

Claims 1 through 9, 12 through 40 and 43 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 through 10 of U.S. Patent No. 6,719,165 in view of U.S. Patent 5,653,358.

Claims 10, 11, 41 and 42 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 through 10 of U.S. Patent No. 6,719,165.

In order to avoid further expenses and time delay, Applicant elects to expedite the prosecution of the present application by filing a terminal disclaimer to obviate the double patenting rejections in compliance with 37 CFR §1.321 (b) and (c). Applicant's filing of the terminal disclaimer should not be construed as acquiescence in the Examiner's double patenting or obviousness-type double patenting rejections. Attached is the terminal disclaimer and accompanying fee.

CONCLUSION

Claims 1 through 43 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicant's undersigned attorney.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Bradley B. Jensen", with a long horizontal flourish extending to the right.

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Date: September 22, 2006
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